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TIMOTHY E SIEGEL
1868 KNAPPS ALLEY
SUITE 206
WEST LINN, OR 97068

EXAMINER	
VERDIER, CHRISTOPHER M	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 33

Application Number: 09/328,931
Filing Date: June 09, 1999
Appellant(s): MORRIS, DAVID CURT

Timothy E. Siegel
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 2, 2002 and the supplemental appeal brief filed March 19, 2003.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is substantially correct. The changes are as follows:

Issue 1 no longer remains an issue. Upon further careful consideration, the terms "substantially flat" in claim 4, line 2 and "slopes gently downwardly" in claim 4, line 4 are believed to set forth the claimed subject mater with a reasonable degree of particularity and distinctness as set forth in MPEP 2173.02. Therefore, the rejection of claim 4 under 35 USC 112, second paragraph is withdrawn.

Issue 4 is no longer an issue because the rejection of claims 1-3 based on Kingsbury was withdrawn in the most recent Office action of December 13, 2002.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 1-4 stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

4,195,800	WALLACE	4-1980
2,108,839	WILFORD ET AL.	2-1938
4,301,981	HARTT	11-1981
3,558,082	BENNIE	1-1971

4,913,376	BLACK	4-1990
5,240,204	KUNZ	8-1993

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Wallace. This rejection is set forth in prior Office Action, Paper No. 31.

Claims 1-4 are rejected under 35 U.S.C. 102(b) as being anticipated by Wilford. This rejection is set forth in prior Office Action, Paper No. 31.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Hartt. This rejection is set forth in prior Office Action, Paper No. 31.

Claims 1-3 are rejected under 35 U.S.C. 102(b) as being anticipated by Bennie. This rejection is set forth in prior Office Action, Paper No. 31.

Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Black. This rejection is set forth in prior Office Action, Paper No. 31.

Claims 1 and 4 are rejected under 35 U.S.C. 102(b) as being anticipated by Kunz. This rejection is set forth in prior Office Action, Paper No. 31.

(11) Response to Argument

With regard to issue 1, which is whether claim 4 should be rejected under 35 USC 112, second paragraph for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention, this no longer remains an issue. Upon further careful consideration, the terms "substantially flat" in claim 4, line 2 and "slopes gently downwardly" in claim 4, line 4 are believed to set forth the claimed subject mater with a reasonable degree of particularity and distinctness as set forth in MPEP 2173.02. Therefore, the rejection of claim 4 under 35 USC 112, second paragraph is withdrawn.

With regard to Appellant's Argument Portion that Applies to Issues 2-8 grouped together, Appellant has restated the examiner's analysis of Appellant's Declarations (Paper No. 22) and Appellant has argued that the lift generated by the standard helicopter assembly is not generated by virtue of the blade set being translated through the air, but in spite of it, and that the clause "thereby" in claim 1 indicates that it is by virtue of the translational movement that the lift is generated. Appellant has further argued that the examiner has not shown that any of the prior art blade sets would generate lift by virtue of being translated through the air as they are rotated, as opposed to generating lift by the action of each blade. These arguments are disagreed with, because the generation of lift in an airfoil is a result of the pressure differential between the

upper and lower surfaces of an airfoil. The differences in curvature between the upper and lower surfaces cause such a pressure differential, which normally results in an upwardly directed force. The examiner previously included excerpts for Appellant from three separate texts discussing lift generated by airfoils in varying degrees. The texts are "Physics, Parts I and II", pages 392-393; "Fluid Mechanics", pages 244-246; and "Fundamentals of Flight", pages 116-130. All of these texts discuss the theory of lift on airfoils. The shape swept out by the blades during rotation has the properties of a lifting body, for the reasons set forth above. Due to the principle of inherency, and for the reasons set forth above, during blade rotation and forward flight, the helicopter blades generate lift as they are translated through the air as they are rotated. If, as Appellant has argued, the helicopter blades of the applied references do not generate lift as translated through the air as they are rotated at a great rate of speed, then there would be no lift (in the form of an upwardly directed force) during blade rotation and forward flight for supporting the weight of the helicopter, thus all helicopters using airfoil shaped blades would drop out of the air and crash to the ground because there would be no lift capable of sustaining the helicopter in the air.

With regard to Appellant's argument that Appellant has never taken the position that a standard helicopter does not generate lift in forward flight, but that this lift is generated by a different mechanism than that specified in claim 1, and that the mechanism by which a standard helicopter blade set generates lift fails to work if the helicopter is moving at too great a rate of speed, it is Office policy to give the terminology in a pending application's claims its broadest reasonable interpretation (*In re Zletz*, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir.

1989)) and limitations from a pending application's specification are not to be read into the claims (*Sjolund v. Musland*, 847 F.2d 1573, 1581-82, 6 USPQ2d 2020, 2027 (Fed, Cir. 1989)). The above applied prior art references have been applied consistent with these Office policies.

With regard to Appellant's argument that in the December 14, 2001 action, the examiner left out the word "thereby" when detailing the characteristics of the Wallace reference and that it cannot be said that the examiner fully addressed the limitations of claim 1 when rejecting it as being anticipated, the examiner disagrees. The word "thereby" is a commonly used word in patent claims, such as "the" or "said". The prior Office action of December 14, 2001 as well as the Office action of December 13, 2002 clearly identified all elements of the Wallace reference corresponding to the claim limitations, and one of ordinary skill in the art would clearly know the meaning of the term "thereby".

With regard to Appellant's arguments that Webster's New World Dictionary defines "camber" as "a slight convex curve of a surface as of a road, a ship's deck, a beam, etc.", that to be cambered helicopter blades should slope downwards towards their outer ends, and that none of the references applied by the examiner have any such camber, the examiner disagrees. Webster's New World Dictionary, Third College Edition, defines camber, in the aeronautical sense, as "the arching curve of an airfoil from the leading edge to the trailing edge." (see attached copy at the end of the Examiner's Answer). Blades 18 of Wallace clearly are airfoil shaped and have such a camber (see figures 2-3 and 5 of Wallace) by the aeronautical definition. Wilford (figures 5-6) show blades 10 with outwardly extending tips 11 that are downwardly inclined and thus

considered to be "cambered" for the same reason that Appellant's downwardly inclined blades are considered to be cambered, as shown in Appellant's own figures 2b, 3b, 4b, 6b, 8b, 10b, 11b, and 12b. Hartt (figure 2) shows rotatable blades 46 that are airfoil shaped and thus are cambered by aeronautical definition. Bennie (figure 11) shows rotatable blades 41, 42 that are airfoil shaped and thus are cambered by aeronautical definition. Black (figures 1-2) shows blades 40, 44 that are inclined and are thus broadly "cambered" due to their inclination. Kunz (figures 1 and 3) shows blades 38/42/26' which similarly have cambers. Note, however, that independent claim 1 does not require the rotatable blades to be cambered.

With regard to Appellant's argument that is hard to understand how the examiner reached the conclusion that any rotating object will sweep out the shape of a lifting body, the context of the statement was with reference to an airfoil shaped body. As the body rotates, it sweeps out the shape of a virtual disk, which creates lift due to the airfoil shape.

Appellant's Exhibit A, which Appellant argues provides scientific support for the principle that a set of rapidly rotating blades may assume the properties of the shape that they are sweeping out, and which Appellant argues shows that a rapidly rotating blade blocks air flow better than a slowly rotating blade, has been considered. However, Exhibit A is not sufficient to overcome the various grounds of rejection of the claims relied upon in the previous Office action because Exhibit A is not specifically directed towards the applied references.

Appellant's arguments with regard to specific issue 2 are that Wallace teaches against the present invention because Wallace shows an actual circular wing 17 that is shaped to be a lifting body, and that rotation of a circular wing does not anticipate Appellant's invention, because claim 1 specifically recites that it is the blades that sweep out the shape virtual disk, and that in the case of a circular wing, the disk is not virtual, but is the physical unchanging shape of the circular wing. These arguments are not agreed with, because the Office action of December 12, 2002 refers to element 17 as the "helicopter blade assembly", and identifies blades 18 as the "rotatable blades which sweep out the shape of a virtual disk having the properties of a lifting body when rapidly rotated by the mast so that as the disk is pushed translationally through the air, it generates lift". The previous Office action clearly indicates that the airfoil shaped blades 18 of Wallace are the rotatable blades, not the circular wing 17 as Appellant has argued. The blades 18 sweep out the shape of a virtual disk as they are rotated by the mast. Wallace (column 4, lines 5-9) states that "In use of the illustrated auto gyro, the pilot can vary the lift characteristics of the rotor by fore and aft tilting movements and also by increasing the pitch of the blades at either side of the rotor while simultaneously decreasing the pitch at the other".

Appellant's arguments with regard to specific issue 3 are that figure 5 of Wilford shows a clear break in orientation between wing portion 10 and wing portion 11, and that every reference to a lifting body from the textbook sections provided by the examiner to the discussion of the disk in Wallace indicates that a lifting body has a gentle curvature without sharp changes. While the examiner agrees with Appellant that figure 5 of Wallace shows a clear break between wing portions 10 and 11, it is noted that Appellant's own figures 2b, 3b, 4b, 6b, 8b, 10b, 11b, and 12b

also show a clear break between blade inner portions 12 and blade outer portions 16 of the rotatable blades, with the blade inner portions 12 being connected to the blade outer portions 16 by respective hinges 14. Therefore, it is respectfully submitted that Appellant's above argument is without merit. With regard to Appellant's argument that every reference to a lifting body from the textbook sections provided by the examiner to the discussion of the disk in Wallace indicates that a lifting body has a gentle curvature without sharp changes, this argument is not agreed with. The textbook sections merely utilize airfoils as exemplary models and do not limit lifting bodies to bodies with gentle curvature without sharp changes, as Appellant has argued. Wilford does not limit his disclosure to a lifting body that has a gentle curvature without sharp changes because figures 5-6 of Wilford generate lift as set forth later below. There is no statement in Wallace's disclosure that the lifting body is limited to a lifting body having a gentle curvature without sharp changes.

With regard to Appellant's argument that absent an explicit teaching, the burden is on the PTO to show that the blade assembly of Wilford could sweep out a virtual disk that would act as a lifting disk, the previous Office action clearly indicated that the assembly of Wilford performs this function. Appellant's arguments that there is simply no reason to believe that the assembly of Wilford could sweep out a disk that would act as a lifting body, absent some showing of another lifting body with a sharp kink in the upper surface, and that it appears that the air would be accelerated upwardly at an acute angle by portion 11 of the Wilford blade but then would not flow directly over portion 10 but would overshoot it, are not agreed with. Wilford (column 3, lines 27-31) states that "The outer portion 11 is hinged by connected hinge 12 to portion 10 and

in flight it takes up a position which is determined by the balance of the forces of lift and acceleration". Wilford (column 3, lines 45-50) states that "A study of the used distribution of lift on a rotor blade shows that by far the greater part of the lift derived is from the outer half of the blade. Therefore, the equalizing of the lifts on opposite sides of the rotor when a forward velocity occurs, is easily accomplished by the flapping of the small outer portion only." Wilford (column 4, lines 37-39) states that "The outer part, which is also the lighter part, is then made to equalize the lifts and/or do the controlling in various ways." These portions of Wilford clearly indicate that the blade assembly of Wilford creates lift, and it is inherently evident that as blades 10/11 of Wilford, rotate, they sweep out the shape of a virtual disk.

Appellant's arguments with regard to issue 5 are that there is simply no indication that the blade set 46 of Hartt sweeps out the shape of a lifting body, and that the blade set 46 is not shaped to do so because the blades have no camber and there is no suggestion in the text that they do so. These arguments are not agreed with. The blade set 46 of Hartt (shown in figure 2) is an element of the rotary wing 32. The abstract of Hartt (lines 5-8) states that "Rotation of the wing drives air centrifugally across the upper and lower surfaces to energize the boundary layer, enhance laminar flow, and produce lift". Hartt (column 1, lines 6-9) states "This invention relates to aircraft having annular wings and, more particularly, to an aircraft having an annular wing which rotates in its own plane to produce lift." Hartt (column 1, lines 55-59) states that "The rotation of the wing applies centrifugal force to the air adjacent the upper and lower surfaces to cause radial flow across the surfaces from the inner edge of the wing to the outer edge and produces a lifting force." Hartt (column 3, lines 46-50) states "As forward speed increases, the

relative wind will overcome the centrifugal effect at the forward portion of the wing and air will flow over it toward the aft portion, producing lift and adding to the forward thrust effect of the rear portion." Figure 2 of Hartt clearly shows that the blades 46 have a camber due to their airfoil shape, and the blades 46 clearly sweep out a virtual disk having the properties of a lifting body when rapidly rotated by the mast.

Appellant's arguments with regard to issue 6 are that Appellant does not understand how the examiner equates aerodynamic warp with camber, and that camber has a specific meaning, which the blades of Bennie do not meet because they do not slope downwardly toward their outer ends. These arguments are not agreed with, because as explained above, the aeronautical definition of camber is "the arching curve of an airfoil from the leading edge to the trailing edge." Figures 11-12 of Bennie clearly show that blades 41, 42 have an airfoil shape, as would readily be recognized by one having ordinary skill in the art. In Bennie, means 58 control the aerodynamic warping of the blades (see column 2, lines 69-71) and as set forth in column 4, lines 71-75 and column 5, lines 1-7, the warping of the blades via servotabs 58' results in either negative blade pitch or positive blade pitch, thus varying pitch and therefore the lift. The lift varies because as the blade pitch is varied, the orientation of the upper and lower surfaces of the airfoils change, increasing or decreasing the pressure differential between the upper and lower surfaces of the blades.

Appellant's arguments with regard to issue 7 are that Black teaches against the present invention because Black shows an actual physical disk 46 that is shaped to be a lifting body, and

that rotation of a circular wing does not anticipate Appellant's invention, because claim 1 specifically recites that it is the blades that sweep out the virtual disk, and that the disk 46 of Black is not virtual, but fully physical, and that there is no suggestion that blades 44 sweep out the shape of a lifting body. These arguments are not persuasive because the previous Office action clearly indicates that it is blades 40, 44 that sweep out the shape of a virtual disk having the properties of a lifting body when rapidly rotated by the mast. The previous Office action did not state that the disk 46 of Black is considered to be the blades, as Appellant has argued. Blades 40, 44 of Black, which are set at various angles of attack, as shown in figures 1-2 and 4, are cambered due to their inclination angles, and generate lift due to their cambered orientation. As the blades 40, 44 of Black are rotated, it is clear that the blades will sweep out the shape of a virtual disk.

Appellant's arguments with regard to issue 8 are that Kunz teaches against the present invention because disk 24 is an actual physical disk and Appellant's claim 1 recites that it is the blades that sweep out the virtual disk and disk 24 of Kunz is not virtual, but fully physical, and that there is no indication that the blade set 38/42/26' sweeps out the shape of an airfoil. Appellant has further argued that structure 26' is described as being fan blades that appear to be very thin and would not appear to have the function of supporting the craft in forward flight, but rather work in conjunction with structure 24 to achieve some other aerodynamic goal. These arguments are not agreed with, because the previous Office action clearly indicates that it is blades 38/42/26' that sweep out the shape of a virtual disk having the properties of a lifting body when rapidly rotated by the mast. The previous Office action did not state that the disk 24 of

Kunz is considered to be the blades, as Appellant has argued. Blades 38/42/26'of Kunz, which are set at various angles of attack, as shown in figures 1 and 3, are cambered due to their inclination angles, and generate lift due to their cambered orientation. As the blades 40, 44 of Black are rotated, it is clear that the blades will sweep out the shape of a virtual disk. The disclosure of Kunz repeatedly refers to lift generation as shown in column 4, lines 4-12, for example, which state that fan blades 26 may have a cambered airfoil cross section and may be set at a fixed optimum pitch for static lift. Column 5, lines 9-16 of Kunz state that outer sections 42 of the blades include a chordwise airfoil cross section so that rotors 38 generate lift when rotated, and discuss varying the pitch of rotors 38 to vary the total lift.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Christopher Verdier
Primary Examiner
Art Unit 3745

C.V.
April 29, 2003

Edward K. Look
Appeal Conferee

Charles G. Freay
Appeal Conferee

Metallurgy to coat (steel) with aluminum by heating in a closed retort containing aluminum powder: the aluminum alloys with the steel surface and forms a protective coating against oxidation

ca|lo·ry (kal'ə rē) *n., pl.* **-ries** CALORIE

ca·lotte (kə lät') *n.* [Fr < It *calotta* < ? Gr *kalyptra*: see CALYPTRA] a small, brimless cap

ca|lo·yer (kal'ə yər, kə loi'ər) *n.* [Fr < It *caloiero* < MGr(Ec) *kalogēros*, monk < *kalos*, beautiful + *gēros, gēras*, old age: see CORN¹] a monk of the Eastern Orthodox Church

cal·pac or **cal·pack** (kal'pak') *n.* [Turk *qālpāk*] a large cap made of felt or sheepskin, worn in some parts of the Near East

Cal·pe (kal'pē, kalpē) *ancient name of* Rock of Gibraltar: see also PILLARS OF HERCULES

calque (kalk) *n.* [Fr, an imitation, tracing < *calquer*, to trace < It *calcare*, to press, trample < L, to tread: see CAULK] a borrowing by which a specialized meaning of a word or phrase in one language is transferred to another language by a literal translation of each of the individual elements *[masterpiece* is a *calque* from German *meisterstück]*

cal·trop (kal'trəp, -träp') *n.* [ME *calketrappe* < OE *calcatrippe*, star thistle & OFr *chaucetrape*, both < ML *calcatrippa* < L *calcare*, to tread upon (< *calx*, heel: see CALCAR) + Gmc **trippon*, TRIP] **1** an iron device with four spikes, placed on the ground so that one spike sticks up to hinder enemy cavalry, **2** a similar device used to puncture pneumatic tires, **3** any of a number of plants with spiny fruiting parts or fruits; specif., *a*) various plants (esp. *Tribulus terrestris*) of the caltrop family *b*) various plants of other families, as star thistle and water chestnut —***adj.*** designating a family (Zygophyllaceae) of dicotyledonous plants, shrubs, or trees (order Sapindales), including guaiacum, creosote bush, and bean caper Also **cal'trap** or **cal'throp** (-thrəp)

ca|lu·met (kal'yə met', -mit; kal'yə met') *n.* [CdnFr < Fr dial., for Fr *chalumeau* < OFr *chalemel* < LL *calamellus*, dim. of L *calamus*, a reed: see CALAMUS] a long-stemmed ceremonial pipe, smoked by North American Indians, as a token of peace, at sacrifices, etc.

CALUMET

Calumet City city in NE Illinois, south of Chicago: pop. 40,000

ca·lum·ni·ate (kə lum'nē āt') *vt., vi.* **-at|ed, -at|ing** [< L *calumniatus*, pp. of *calumniari*, to slander < *calumnia*: see CALUMNY] to spread false and harmful statements about; slander —**ca·lum'ni|a'tion** *n.* —**ca·lum'ni|a'tor** *n.*

ca·lum·ni·ous (kə lum'nē əs) *adj.* [L *calumniosus*, full of tricks, swindling] full of calumnies; slanderous —**ca·lum'ni·ous|ly** *adv.*

cal·um|ny (kal'əm nē) *n., pl.* **-nies** [Fr *calomnie* < L *calumnia*, trickery, slander < IE base **kēl-, kol-*, to deceive; confuse > OE *hol*, slander] **1** a false and malicious statement meant to hurt someone's reputation **2** the uttering of such a statement; slander

☆cal|u·tron (kal'yə trän') *n.* [CAL(IFORNIA) U(niversity), where developed + -TRON] a large, electromagnetic mass spectrometer used for separating isotopes in quantity

Cal·va·dos (kal'və dōs', kal'və dôs') *n.* [after *Calvados*, department in NW France, where chiefly distilled] *[sometimes* **c-***]* a French brandy distilled from apple cider

cal·var|i|um (kal ver'ē əm) *n., pl.* **-var'|i|a** (-ə) [ModL < L *calvaria*, skull < *calva*, skull] the upper, domed part of the skull Also **cal·var'|ia** —**cal·var'|i|al** or **cal·var'|i|an** *adj.*

Cal·va|ry (kal'və rē) [LL(Ec) *Calvaria* < L, skull (see prec.): used to translate Gr *kranion*, skull (see CRANIUM) & by the Evangelists to transl. Aram *gālgālthā*, GOLGOTHA] *Bible* the place near Jerusalem where the crucifixion of Jesus took place: Luke 23:33, Matt. 27:33 —*n., pl.* **-ries** [**c-**] **1** an outdoor representation of the crucifixion of Jesus **2** any experience involving intense pain or anguish

calve (kav, käv) *vi., vt.* **calved, calv'ing** [ME *calven* < OE *cealfian* < *cealf*, CALF¹] **1** to give birth to (a calf) **2** to release (a mass of ice): said of a glacier or an iceberg

Cal·vert (kal'vərt), **George** *see* BALTIMORE, Lord

calves (kavz, käv) *n. pl. of* CALF¹

Cal·vin (kal'vin) [ModL *Calvinus* < Fr *Cauvin, Chauvin*, prob. < L *calvus*, bald: see CALLOW] **1** a masculine name **2 John** (born *Jean Caulvin, Cauvin*, or *Chauvin*) 1509-64; Fr. Protestant reformer **3 Melvin** 1911- U.S. chemist & educator

Cal·vin·ism (-iz'əm) *n.* **1** the Christian doctrines of John Calvin and his followers, esp. predestination and salvation of the elect solely by God's grace **2** practices and principles based on Calvin's teachings, associated with a stern moral code —**Cal'vin·ist** *n., adj.* —**Cal'vin·is'tic** or **Cal'vin·is'ti·cal** *adj.* —**Cal'vin·is'ti·cal|ly** *adv.*

cal·vi·ti|es (kal vish'i ēz') *n.* [L < *calvus*, bald: see CALLOW] a loss of hair, esp. on top of the head

calx (kalks) *n., pl.* **calx'|es** or **cal·ces** (kal'sēz') [L, small stone; lime: see CALCIUM] **1** the ashy powder left after a metal or mineral has been calcined **2** the heel of the foot

ca·ly·ces (kā'lə sēz', kal'ə-) *n. alt. pl. of* CALYX

ca·ly·cine (kā'lə sin, -sīn'; kal'ə-) *adj.* of or like a calyx, Also **ca·lyc|i·nal** (kə lis'ə nəl)

ca·ly·cle (kā'li kəl) *n.* [see fol.] EPICALYX

ca·lyc|u·lus (kə lik'yōō ləs) *n., pl.* **-li'** (-lī') [ModL < L, dim. of *calyx*, CALYX] *Anat., Zool.* a small, cuplike part, as a taste bud, or a cuplike depression, as in a coral skeleton

Cal·y·don (kal'ə dän') ancient city in S Aetolia, central Greece —**Cal·y·do'ni·an** (-dō'nē ən, -dōn'yēn) ***adj.***

Calydonian boar *Gr. Myth.* a boar sent by Artemis to scourge the fields of Calydon and killed by Meleager

ca·lyp|so (kə lip'sō) ***adj.*** [altered < ? Trinidad patois *kaiso*, town crier, who gave news in rhythm and doggerel] designating or of songs improvised and sung as originally by natives of Trinidad: they are satirical ballads, usually topical, characterized by wrenched syllabic stress and syncopated rhythms —***n., pl.*** **-sos** a calypso song or calypso music

Ca·lyp|so (kə lip'sō) [L < Gr *Kalypsō* < *kalyptein*: see fol.] in Homer's *Odyssey*, a sea nymph who keeps Odysseus on her island for seven years —*n., pl.* **-sos** [**c-**] an orchid (*Calypso bulbosa*) growing in boggy regions of the Northern Hemisphere: its solitary pink flower has purple or yellow markings

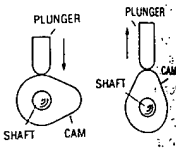
ca·lyp·tra (kə lip'trə) *n.* [ModL < Gr *kalyptra*, covering for the head, veil < *kalyptein*, to conceal, cover: for IE base see CONCEAL] **1** the remains of the female sex organ, or archegonium, of a moss, forming the caplike covering of the spore case **2** any similar covering of a fruit or flower —**ca·lyp'trate'** (-trāt') ***adj.***

ca·lyp·tro·gen (kə lip'trə jən) *n.* [< prec. + -GEN] the layer of actively dividing cells at the tip of a root in many plants, as grasses, that produces the root cap

ca·lyx (kā'liks'; *also*, kal'iks') *n., pl.* **ca'lyx'|es** or **ca·ly·ces** (kā'lə sēz', kal'ə-) [L, outer covering, pod < Gr *kalyx*: for IE base see CALIX] **1** the outer whorl of protective leaves of a flower, usually green **2** *Zool.* a cuplike part or cavity

cal·zone (kal zō'nē, -zōn') *n.* a kind of Italian turnover filled variously with cheese, meat, and vegetables

cam (kam) *n.* [Du *cam*, orig., COMB¹] a moving piece of machinery, such as a wheel, projection on a wheel, etc., that gives an eccentric rotation or a reciprocating motion to another wheel, a roller, shaft, etc., or that receives such motion from it



CAM

CAM (kam) *n.* computer-aided manufacturing: see CAD/CAM

Cam **1** Cambodia **2** Cameroon

CAm Central America

Ca·ma·güey (kä'mä gwā') city in EC Cuba: pop. 262,000

ca·ma·ra·de|rie (kam'ə räd'ə rē, käm'-) *n.* [Fr < *camarade*, COMRADE] loyalty and warm, friendly feeling among comrades; comradeship

cam|a·ril|la (kam'ə ril'ə; *Sp* kä'mä rēl'yä) *n.* [Sp, dim. of *camara*, chamber < L *camera*, CAMERA] **1** a small meeting room **2** a group of secret or confidential, esp. unofficial, advisers; cabal

☆cam·ass or **cam|as** (kam'əs) *n.* [AmInd (Chinook) < *chamas*, sweet] any of a genus (*Camassia*) of North American plants of the lily family, with sweet, edible bulbs and racemes of drooping, bluish flowers: see also DEATHCAMAS

Camb Cambodia

cam·ber (kam'bər) *n.* [OFr *cambre*, dial. var. of *chambre*, bent < L *camur*, crooked, arched: for IE base see CAMERA] **1** a slight convex curve of a surface, as of a road, a ship's deck, a beam, etc. **2** in automotive wheel alignment, a slight tilt given to each of a pair of wheels on an axle; positive camber indicates that the bottoms are closer together than the tops; negative camber indicates the opposite situation: see TOE-IN **3** *Aeron.* the arching curve of an airfoil from the leading edge to the trailing edge —***vt., vi.*** [Fr *cambrer*] to arch slightly; curve convexly

cam·bist (kam'bist) *n.* [Fr *cambiste* < It *cambista* < *cambiare*, to exchange < LL *cambiare* < L *cambire*: see CHANGE] **1** an expert in foreign exchange, as a dealer in bills of exchange **2** a book that gives the rates of foreign exchange and equivalents of measures, weights, etc.

cam·bi|um (kam'bē əm) *n.* [ModL < ML < LL *cambiare*: see CHANGE] a layer of formative cells between the wood and bark in dicotyledonous plants: these cells cause the girth of the stem to increase by dividing and differentiating to form new xylem and phloem tissue, which will eventually become wood and bark —**cam·bi|al** ***adj.***

Cam·bo·di|a (kam bō'dē ə) country in the S Indochinese Peninsula, a French protectorate from 1863 until independence, 1954: 69,898 sq. mi (181,035 sq. km); pop. 6,388,000; cap. Phnom Penh —**Cam·bo'di|an** ***adj., n.***

Cam·bri|a (kam'brē ə) [ML, var. of *Cumbria* < base of OCelt *Combroges*, lit., co-landers > Celt *Cymry*, Welshmen] *old poet. name for* WALES

Cam·bri|an (-ən) ***adj.*** **1** of Cambria; Welsh **2** designating or of the first geologic period in the Paleozoic Era, marked by a profusion of marine animals, esp. trilobites and brachiopods —***n.*** a native or inhabitant of Cambria; Welshman —**the Cambrian** the Cambrian Period or its rocks: see also GEOLOGY chart

Cambrian Mountains mountain system of central Wales: highest point, 2,970 ft. (905 m)

cam·bric (kām'brik) *n.* [after *Kamerÿk*, Fl name of *Cambrai*, city in N France, where orig. made < L *Camaracum*] **1** a very fine, thin linen **2** a cotton cloth that is like this

☆cambric tea a hot drink of milk, sugar, and water or, often, weak tea

Cam·bridge (kām'brij') [ME *Caumbrigge* < OE *Grantanbrycge*, bridge over the Granta (now called the Cam) River] **1** city in England, in Cambridgeshire: pop. 100,000: site of Cambridge Uni-